



RECORDED

A.D. 1862, 14th AUGUST. N° 2296.

Converting Sugar into Alcohol and Vinegar.

LETTERS PATENT to William Bird Herapath, of 32, Old Market Street, in the City of Bristol, Physician and Consulting Chemist, for the Invention of "IMPROVEMENTS IN TREATING CRYSTALLIZABLE SUGAR TO RENDER IT MORE SUITABLE FOR FERMENTATION AND CONVERSION INTO ALCOHOL AND VINEGAR."

Sealed the 10th February 1863, and dated the 14th August 1862.

PROVISIONAL SPECIFICATION left by the said William Bird Herapath at the Office of the Commissioners of Patents, with his Petition, on the 14th August 1862.

I, WILLIAM BIRD HERAPATH, of 32, Old Market Street, in the City of 5 Bristol, Physician and Consulting Chemist, do hereby declare the nature of the Invention for "IMPROVEMENTS IN TREATING CRYSTALLIZABLE SUGAR TO RENDER IT MORE SUITABLE FOR FERMENTATION AND CONVERSION INTO ALCOHOL AND VINEGAR," to be as follows:—

This Invention has for its object improvements in treating crystallizable 10 sugar, to render it more suitable for fermentation and conversion into alcohol. I employ hydrochloric acid or other dilute mineral acid free from contamination with iron to convert crystallizable sugar into uncrystallizable sugar, so as to render it more suitable for the purpose of fermentation and conversion into

Herapath's Improvements in Converting Sugar into Alcohol and Vinegar.

alcohol, or for the manufacture of vinegar, and I afterwards neutralize the free acid by means of carbonate or bi-carbonate of soda or potassa, or some alkaline solution, thus producing a soluble alkaline chloride or other combination, the presence of which in small quantities is unobjectionable.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed 5
by the said William Bird Herapath in the Great Seal Patent Office
on the 14th February 1863.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, **WILLIAM**
BIRD HERAPATH, of 32, Old Market Street, in the City of Bristol, Physician
and Consulting Chemist, send greeting.

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WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fourteenth day of August, in the year of our Lord One thousand eight hundred and sixty-two, in the twenty-sixth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said William Bird Herapath, Her special licence that I, the said William 15 Bird Herapath, my executors, administrators, and assigns, or such others as I, the said William Bird Herapath, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great 20 Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for
“**IMPROVEMENTS IN TREATING CRYSTALLIZABLE SUGAR TO RENDER IT MORE SUITABLE FOR FERMENTATION AND CONVERSION INTO ALCOHOL AND VINEGAR**,” upon the condition (amongst others) that I, the said William Bird Herapath, my executors or administrators, by an instrument in writing under my, or their, or one of 25 their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said William Bird Herapath, do hereby 30 declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:—

My Invention consists in preparing cane, beet, or other crystalline sugar of like character, so that its fermentable properties shall be greatly increased, and 35

Herapath's Improvements in Converting Sugar into Alcohol and Vinegar.

the process of fermentation rendered more certain and constant thereby, and I treat it in the following manner:—I dissolve the sugar in hot water, either previously or subsequently acidulated with tolerably pure hydrochloric acid (but more especially rendered free from all contamination with iron) and having 5 raised the temperature of the mixture from about 180° Fahrenheit to 212°, and kept it at that temperature during 2 or 3 hours, more or less, I neutralize the acid by adding to the mixture a sufficient quantity of carbonate of soda, carbonate of potassa, lime water, milk or cream of lime, carbonate of lime, or any other suitable substance, and if no excess of these neutralizing agents has 10 been improperly applied, the solution will be immediately in a fit state for undergoing the process of fermentation without undergoing any further change than the simple reduction of the temperature and gravity to those points at which the process is usually begun in the brewing trade; but if the colour of the sugar employed has been dark or high colored, it might be necessary for some 15 purposes to further submit it to a decolorizing or bleaching process, so as to render it sufficiently free from colour to be serviceable for the end in view.

The manner in which I carry my Invention into effect is as follows:—To each hundredweight of cane or beet sugar dissolved in water so as to form a syrup of the gravity of from 8° to 35° Beaumé I add from 3 to 4 fluid ounces 20 of pure hydrochloric acid, having a specific gravity about 1.160 previously diluted with water or not as found desirable, and then I maintain the solution at a temperature varying from 180° Fahrenheit to 212° Fahrenheit from a period varying from one to three hours, at the expiration of which time the desired change in the composition and properties of the sugar will be effected. 25 I do not limit myself to the above-named proportions, periods, or temperatures, as a smaller quantity of acid will effect the change at a lower gravity of saccharine solution, or if the action be continued during a longer period at an increased temperature.

Other acids will effect the same change, but none appear so suitable for 30 the purpose of my Invention as the hydrochloric, as the soluble products which remain in the solution of the sugar after the acid has been neutralized by any of the salts or preparations of soda, potassa, or lime, are the ordinary constituents of most spring or river waters, and of those generally employed in the arts, whilst the quantities found necessary for the purpose are so incon- 35 siderable, that the extra products may be safely disregarded as immaterial and unimportant. The change will be known to have been accomplished by the use of the polariscope, the primitive rotation from left to right being changed from right to left, and the process of conversion should be continued until the

Herapath's Improvements in Converting Sugar into Alcohol and Vinegar.

index of rotation of the polariscope remains constant for the same gravity of syrup and for the same temperature.

In the neutralization of the acid, I prefer a solution of carbonate of soda or other suitable preparation of soda for the purpose, as it has been often found desirable by brewers to add a certain proportion of the product, common salt, 5 to a brewing of wort when the water employed is deficient in that ingredient, but should the water already contain a large proportion of common salt, it may be preferable to use carbonate of potassa or other suitable preparation of potassa, as the product chloride of potassium is less easily discovered by the palate; but in case the water is comparatively free from salts of lime, it may 10 be preferable, on the grounds of economy alone, to use lime water, cream of lime, or any other suitable preparation of lime for the purpose of combining with the free hydrochloric acid used, as the product then will be chloride of calcium, and not injurious to the syrup, and incapable of interfering with the process of fermentation, whilst the quantity employed will be inappreciable to 15 the taste, and not capable of being discovered except by processes of chemical analysis. All those compounds being present in most spring waters are not objectionable, and do not increase the hardness of the water; but should it be advisable to destroy the color of the saccharine solution, after conversion, and previously to submitting it to the processes for fermentation, the neutralization 20 of the hydrochloric acid may be accomplished by employing a solution of hypochlorite of lime or hypochlorite of soda, which containing, as it usually does, free lime, or, in the latter case, carbonate of soda, also readily neutralizes the acid, and discharges the dark color at the same time.

The point of neutralization is indicated in the usual way by the fact that 25 blue litmus paper is no longer reddened by the acid. Every fluid ounce of pure hydrochloric acid of specific gravity 1.16 will require about eleven drachms and ten grains of crystallized carbonate of soda for its neutralization, and will produce four drachms and a half of common salt, the loss in weight being due to the water present in both the hydrochloric acid and the crystals 30 of carbonate of soda employed. It has been found desirable, therefore, to dissolve crystallized carbonate of soda in the proportion of eleven drachms and ten grains to each gallon of water; when thus made every gallon of this solution will exactly neutralize one fluid ounce of the hydrochloric acid used. If nine pounds and nine ounces of crystallized carbonate of soda be dissolved 35 in one hundred gallons of water, each gallon will be of the said strength, and capable of neutralizing one fluid ounce of the above hydrochloric acid.

The employment of acid in this process somewhat limits the materials

Herapath's Improvements in Converting Sugar into Alcohol and Vinegar.

employed for the formation of the apparatus or vessels necessary; but as wooden vats are in common use in all breweries, &c., these are at hand, and will be serviceable for the purpose, but all iron, zinc, or copper materials should be most carefully avoided, as the acid will corrode and destroy them.

5 I prefer lead as the metal to be used for the pipes necessary for conveying steam into the vessel in order to maintain the fluid at the proper temperature, and I employ either a coil of lead pipes placed within or around the inside of the trough, and traversed by steam, or I heat the acid saccharine liquid by "blowing in steam" in the same manner as that usually adopted by sugar 10 refiners in dissolving or "blowing up" their sugars, as this mode of heating exposes a smaller quantity of lead pipe to the action of the acid, and occasions a more uniform distribution of the heat, and a more thorough mixing of the sugar with the water and acid employed. The neutralization of the acid may be accomplished in the same vessel immediately after the conversion, or the 15 liquid may be run off into another vessel for that purpose, as thought desirable.

In using this process for the preparation of cane or beet sugar for the purposes of distillers or vinegar makers, it may not be necessary to so scrupulously avoid the presence of iron as when employing it for the brewing 20 trade, as the hops which must be subsequently used would produce a black color with the ferruginous impurity. The hydrochloric acid may be added to the syrup instead of being mixed with the water previous to the solution of the sugar.

The choice of methods may be governed by that mode of applying heat to 25 the mixture which is subsequently to be made use of; if the preferable process of "blowing up by steam" be adopted," the ready mixing of the materials is ensured by the motion given to the mixture by the action of the steam, and when desirable the production of various currents may be accomplished by the introduction of several "steam blowers" into the apparatus if 30 this be of large size, so that it would be immaterial whether the acid be added to the water first, or the sugar previously dissolved. But if a coil of steam pipe be used as the heating method, the acid should be previously added to the water as it would more readily mix, and the sugar should be dissolved by placing it on trays or supports of cane or wicker work. Canvas or other 35 suitable material placed at or near the surface of the water, and arranged so as to permit the hot water or steam to have free solvent action on the sugar, whilst the gravity of the solution produced would carry it away, and the boiling motion of the acid watery liquid occasioned by the steam coil would

Herapath's Improvements in Converting Sugar into Alcohol and Vinegar.

produce the necessary mixture of the various materials. All mechanical means of agitating the mixture would thus be rendered unnecessary, as such motion is not requisite for the conversion of the sugar, and does not assist in accomplishing it.

In witness whereof, I, the said William Bird Herapath, have hereunto 5
set my hand and seal, this Tenth day of February, in the year of our
Lord One thousand eight hundred and sixty-three.

WILLIAM BIRD HERAPATH. (L.s.)

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